Real World Metadata Management for Resource Discovery: proof of concept across education and library sectors in Tasmania

Abstract: In 2003 Tasmania's principal educational and cultural organisations undertook an investigation into developing appropriate discovery tools to share digital assets. In this project an agreed set of metadata elements constituting a minimal application profile, and a process for metadata creation and use across the education and library sectors (including basic workflows and administrative processes) were developed. The aim was to facilitate searching across e-learning infrastructure domains and across systems and institutions. Resource discovery testing was undertaken with the COLIS Demonstrator to test the application profile against some real world data. The principal finding was that a minimal profile can be useful yet cost efficient. The minimal profile also establishes a base upon which further development can take place.

1. Background

This paper summarises the report of a research project (University of Tasmania, 2004) undertaken by four Tasmanian educational and cultural organisations under the auspices of the Macquarie E-Learning Centre of Excellence with funding under the Interaction of IT Systems & Repositories Project 2003-2004. The four Tasmanian bodies were the University of Tasmania, the State Library of Tasmania, the Tasmanian Department of Education and TAFE Tasmania.

The project was an investigation into the use of metadata for enabling the discovery of digital resources – learning objects - in the educational and cultural sectors. The emphasis was on ways of solving real-world problems concerned with interoperability and resource sharing. The project built on the work done at the metadata standards level (Dublin Core and IEEE) but because many of these standards and resulting schemas are elaborate and unaffordable, the project investigated ways to implement them (in the form of an application profile) that would work across sectors in a real-world and affordable manner.

The project also looked at interoperability issues related to the non-technical factors that need to be addressed in a multi-sector resource sharing environment. These non-technical factors included the quality of the content of metadata fields in the retrieval of resources, the impact of data entry conventions and rule sets, and the degree to which word order, vocabularies etc are relevant factors in retrieval of resources from different systems. Some analysis of the financial cost of tagging records was also included in the study.

The project was also an investigation into resource discovery issues and included testing retrieval against the aggregated metadata generated by the institutions, identifying what improvements needed to be made to the application profile and content guidelines, and to the COLIS Demonstrator, in order to provide successful and appropriate search results for users within each community.

An essential element in the development of interoperable content repositories for sharing digital objects (learning resources, content to be published to websites etc) is the ability to describe the content of these resources briefly and consistently so that they can be discovered and reused. Just as libraries have developed indexing and

cataloguing systems over the years to describe the content of books and periodical literature, it is now necessary to develop affordable approaches for describing content in learning resources used in learning management systems such as WebCT, Blackboard and non-proprietary systems.

1.1 Learning Objects

A learning object can be any entity, digital or non-digital, which can be used or referenced in technology supported learning. A learning object can be physical, for example a text, workbook or CD-ROM, or online, such as an electronic text, a .gif graphic image, a QuickTime movie or a Java applet. They can be applied to a range of purposes, in a range of settings by teachers, lecturers, designers, managers, trainers, content writers and learners. With appropriate metadata descriptions, they become modular units comparable to Lego blocks that can be assembled together to form lessons and courses. Some commentators and theorists in the field talk about learning (or instructional) components, learning assets, and learning objects in hierarchical terms, although simple and consistent descriptions of what distinguishes one from another are not really in abundance (Higgs et al, 2003).

1.2 Metadata

Metadata is structured data, which describes the characteristics of a resource - essentially it is information about information. It assists in locating the specific information users are looking for. Cataloguing systems used in libraries, museums and archives are classic examples of how metadata is used for non-digital information. In the digital world, searches are most commonly conducted through search engines such as Google or Yahoo. However, these search engines often return unexpected results because, in the digital world, metadata systems are still developing an
d most searches are based on key words only. Search engines will return you all the instances of the word you searched for no matter what the context. The real measure of good metadata is the level of discovery; that is, the ability to deliver a contained set of results with a high proportion of relevance to the subject matter. Even though complying with existing standards is seen as imperative to obtain interoperability, fortunately, implementers of standards need not use every element within a standard. They can also use elements from more than one standard and add elements specific to their needs. The resulting list of elements is known as an application profile. Because there is a variety of standards, the standard implementers and developers adopt will depend on the requirements of their specific implementations (McGreal, 2001).

1.3 Discoverability

For the purposes of this research the definition of discoverability was *the extent to which metadata assists in the effective and efficient retrieval of digital objects*.

2. Methodology

Because the study was done in a number of stages with different emphases, a number of research methods were used. The first three stages included the Development of the Metadata Application Profile, metadata creation and harvesting and some pilot discoverability testing. These stages were conducted using focus groups with expertise in cataloguing, metatagging and information systems. The fourth stage – the Formal Discoverability Testing, had a more complex methodology.

The Goals of the testing were:

1. To determine how metadata affects search results when searching for learning objects contributed from across sectors and organisations.

2. To characterise the search strategies used for searching learning objects in relation to the metadata.

The testing procedure revolved around questions or tasks related to the possible needs of teachers/lecturers/instructional designers. The tasks were capable of completion through discovering appropriate learning objects from the testbed set up using the metadata developed in Stage 2. The participants consisted of 12 clients/users from each of the organisations. The aim was to determine the level of difficulty in finding them and the usefulness of the metadata.

The procedure included:

1. Pre-test Orientation
2. Pre-test Questionnaire
3. Retrieval of the specific learning objects determined to be objectively relevant.
4. Documentation of the search strategy or strategies used to search by an observer and monitor where the following was recorded:
    - Searches Terms/Strategy
    - Number of objectively relevant items retrieved.
    - Total number of items retrieved.
    - Time taken for each search
    - Number in the list of results of the relevant item
5. Post-test Questionnaire. This included a question about the number of pertinent items retrieved.

The data was collected manually. Participants were asked to complete a standard set of ten questions/tasks. Participants were also required to fill in two questionnaires, one pre-test and one post-test. The pre-test questionnaire gave information about the organisation they were from, their position title, their searching experience and background. The second questionnaire was completed post-test and was designed to elicit information regarding their experience and the results they achieved, and if they thought anything could be improved or was missing.

Each participant was tested singly. The participant worked through the questions from the question sheet. An observer wrote down their search strategy and a monitor timed the search. The observer had a page of the expected results for each search question. Once the participants had completed the ten questions they were given the Post-test questionnaire and encouraged to discuss any aspect of the test or offer comments or recommendations.

3. Results

3.1 Development of the Tasmanian Metadata Application Profile

The focus group for Stage 1 decided not to try and define *Learning Object*. However, it was noted that the definition of a Learning Object does impact upon the creation of Metadata Guidelines, especially in relation to the granularity of the resources described and where a learning resource consists of multiple parts. The group decided to make no differentiation between components, assets and objects. If an object was worth submitting and tagging, it would have the same status as any other object.

The group also made the assumption that the individuals tagging the objects would be variable and diverse. Some organisations might have teaching staff tagging, some librarians and some a mixture and some both at various stages. Therefore any MAP

the group developed would need to take account of professional and non-professional levels of cataloguing skill among the contributors. A preference was expressed for professionals to add the subject element data.

It was assumed that on occasions objects might be duplicated. The profile and guidelines would need to account for this possibility. There did not appear to be any significant advantage to trying to prevent duplication considering the administrative overhead involved.

The group also agreed that any systems adopted by organisations whereby metadata was shared would include a method of tagging that showed the originating institution of the data either as a metatag or some other method. It was accepted that this was not necessary for discovery – although it may impact on the selection of a resource - but was the one concession made to the inclusion of administrative metadata, and as such would not necessarily be included in the Metadata Application.

It was decided that relational aspects of objects would not be addressed by a separate element or elements. The object as a whole would be described which may or may not include mention of its constituent parts. If the constituent parts are considered worthy as a learning object in their own right another separate record could be created. If a relationship was known and significant, it could be expressed in the description.

The content guidelines were drawn significantly from:

- National Library of Australia and the State Library of Tasmania *Guidelines for the Creation of Content for Resource Discovery Metadata*
- *TAFE Online Project 8 Metadata Tagging Guidelines(Version 1.0)*
- *Tasmanian Teachers' e-Centre Metadata Application Profile (Draft)*
- *State Library of Tasmania Metadata Standards (Draft)*

3.2 Elements agreed for the Tasmanian Metadata Application Profile

i) Title

There was little debate about this most basic element. Everyone thought it essential. Title was defined as 'a name given to the resource'. However, there were some questions about how it would be used. One issue was – what should be the maximum occurrence. It was decided that there was no need for 'title' to be unique, so title should be repeatable. It was noted that this could be an issue for the end presentation developers as IEEE LOM.General.Title only allows one title.

ii) Identifier

There was protracted discussion about identifier. Everyone acknowledged that each record should have an identifier, Should it be unique, from where should it be sourced? Initially thoughts were that perhaps identifier should be the unique 'key' for the record. Then discussions moved to should it be some sort of record number from the originating system, or a record number produced by the LOMS. The matter remained unresolved until discussion turned to Location/URL of the item and it was decided to combine these two functions into the one element. But because identifier and Location/URL are combined, the group could not make it non-repeatable/unique as there was a consensus that more than one organisation might tag the same URL.

iii) Description
A description element was agreed to be essential. 'Description' in this sense was defined as 'an account of the content of the resource'. The purpose of the element provides a free-text summary that describes the resource. While using keywords to search the description is the least precise method of searching, it can be useful for picking up terms not included in the subject element. The description is also often used in the display of a search results list, helping the user to identify whether or not the resource appears relevant, and this is how the group assumed it would be used.

iv) Subject
Subject was a problematic element. Discussions generally favoured the inclusion of subject, but there was some uncertainty about how it should be implemented. Subject was defined as 'the topic of the content of the resource'. The question as to whether a thesaurus should be used was debated at length. The selection of a recommended thesaurus was problematic as the options would be determined by a number of factors, including; who enters the metadata – librarians or teaching staff, the needs of the various sectors, e.g. VET resources may require a specific thesaurus. The use of multiple thesauri may increase costs and reduce sustainability and also effect the retrieval of related material. There was also the question of a browsable subject hierarchy – was this required? *Intralibrary* has a mandatory thesaurus set up as a browsable hierarchy. Should it be assumed all LOMS will have such a feature? In the end it was thought that while one may assist in discovery, it was not essential. There would also be issues of which hierarchy, and the additional costs required to maintain and use it.

However, a strong preference was given to using a thesaurus for choosing subjects as this would provide consistency in the use of terms and assist with focused searching. The group ended up making the use of LCSH a recommendation but not mandatory. The group set down some additional guidelines regarding the entry of unstructured keywords if a suitable term is not available in LCSH, or if the contributor does not have LCSH expertise. The group recognised that this partly diluted the advantages of using a thesaurus, but were mindful that the aim was for a practical, affordable, real-world solution.

The group also produced the content guidelines for entering data for the elements specified. These guidelines are included in the full report (University of Tasmania, 2004, Appendix A).

3.3 Elements considered but rejected
A number of Dublin Core elements (Date, Coverage, Rights, Creator, Type, Format, Language) were considered for inclusion but ultimately rejected during the first round of discussions as they were not considered essential. Some were classified as being additional possible elements for future consideration .

It was decided also that the Educational metadata elements were possibilities - elements such as; Audience, Educational sector, Document type, Curriculum. Even though they might be potentially useful for discovery and for selecting from search results, they were considered too problematic to apply as they required multiple vocabularies available for each element, were especially difficult across sectors, some had complicated vocabularies making inconsistent application a possibility and the increased cataloguing overheads would not pay off.

3.4 Additional possible elements for the minimum MAP

These elements (from Dublin Core) were considered not essential minimum elements but may add additional value to the description and the discovery of a resource, and could be considered in the future:

ii) Creator

Users may expect the ability to search on author, but it is problematic to apply, what form of name, which name, identifying the creator, intellectual property issues etc.? It would have to be optional as not all resources may have an easily established Creator.

iii) Type or Format

It was thought it might be useful to provide users with a warning of what file type they are opening (although most browsers now cope with the most common file types). It too would be problematic to apply as there would be a mixture of types in aggregated resources, and the vocabularies are limited and outdated. Alternative vocabularies exist but with similar problems (although CETIS is developing a new vocabulary). Displaying the URL may indicate a file type, depending on the structure of the URL. Title and description may provide a guide. It is not essential for discovery.

The group noted that File type of the indexed resource was Recommended in DC, Optional in AGLS, Desirable in EdNA, and Non-mandatory in OTEN, and mandatory in The Le@rning Federation (System maintained – also TLF catalogues at the granular level). They looked at possible vocabularies for use if it was adopted and decided that the Dublin Core IMT vocabulary was dated and difficult to apply. The group decided that the Format tag should only be considered if content could be system generated. The technical team was consulted and it was apparent that this was not possible in the COLIS Demonstrator. Also the group found that a number of resources in the COLIS project will be zipped IMS packages. These will automatically unzip as users open them. The manifest attached to the IMS compliant package does not contain details about the formats contained in the IMS zip file (html, images, shockwave/flash files). These IMS packages do not appear to allow the COLIS delivery system to automatically generate/display file types. They recommended that as system generation was not yet possible and Format is not required for resource discovery, Format was not recommended. The group noted that the description element might be used to highlight significant aspects of the format. This was already noted on P.11 of the draft guidelines: For example:

> *A slide presentation and lesson plan which explore global warming from an Antarctic perspective*

The Group left open the possibility of Format being included in the future and provided some draft guidelines for its possible use.

The group thought that Type was not essential for minimum discovery, although may be used to refine or select from a set of search results. They thought that there would be little use in the tag unless it was chosen only from a controlled vocabulary. However they thought there were limitations of existing vocabularies. Some are:

- limited and out of date (e.g. MIME last updated last updated 2001 October 16)
- Database specific – EdNA, IEEE, The Le@rning Federation use different vocabularies
- problematic to apply, e.g. mixture of types in aggregated resources

Therefore the group did not recommend Type for inclusion in the Tasmanian Metadata Application Profile.

iv) Language

The group thought this element might be a useful filter for discovery. How often it might be used was debatable. It certainly would not be essential for discovery, as this type of information could be in the description or subject, or keyword searches using foreign language words (in some cases) would be an alternative.

v) Date

The group defined date as 'a date associated with the creation or modification of the resource'. They thought that the preferred option was for date to be system generated from the date embedded in the resource or from the file information rather than embedded in the metadata. They also thought there was little point being too prescriptive about the element and believed there was merit in the notion that "any date is better than no date" and if applied could refer to the creation or modification of a resource. In the second round of discussion it was decided to include date in the MAP if it could be system generated It was noted that date qualifiers can be difficult to apply and the metadata content can become inaccurate (eg. If a web site is modified the day after a metadata record is created). It was therefore recommended that qualifiers are not used.

Table 1. Agreed Profile

	Tas	**DC**	**AGLS**	**EDNA**	**IEEE**	**OTEN**	**The Le@rning Federation**	**UK LOM**
DC.Title	M	R	M	M		M	M	M
DC.Identifier	M	R	M for online resources	M		M	M	M
DC.Description	M	R	O	M		M	M	M
DC.Subject	M	R	M if no function	M		M	M	
DC.Date	M *	R	M	M		M	M	M
LOM.Meta-Metadata.Contribute.Entity	M *	-	-					

M Mandatory
R Recommended
* System generated if possible

3.5 Metadata Creation and Harvesting

The focus group for Stage 2 decided to choose a few subject areas common across the institutions and either harvest or import metadata for learning objects or find and tag new objects with relevance to those subject areas. The learning areas chosen were computing/information systems, business and the Antarctic. The Department of Education and the State Library already had objects tagged with the elements (and more) in the Tasmanian MAP, so these were extracted from the local systems and entered into the testbed. The University and TAFE had not started metadata tagging

of resources in an organised way. It was therefore an opportunity to investigate the time and workflows involved in tagging under the minimalist MAP.

i) Generation of New Metadata

Learning objects were tagged in different combinations of metadata from the MAP using the guidelines. The group noticed a difference in the time taken depending on the type of learning object – whether it was mainly textual or mainly graphical. The average times for tagging were:

Mainly Textual Learning Object :

Title only	1 minute
Title and Description	3.5 minutes
Title, Description and Subject	5.5 minutes
Title and Subject	3 Minutes

Mainly Graphical Learning Object:

Title only	1 minute
Title and Description	4 minutes
Title, Description and Subject	6 minutes
Title and Subject	3 Minutes

To enter records directly into *Intralibrary* it was necessary to also enter the URL (identifier), date, and contributing organisation as well as the title, description and subject metadata, so each record took closer to 8 minutes. This emphasised the desirability of some elements being created automatically, as significant time savings could result. It was noted that if this was the sort of time it took for this minimalist MAP, the resources required to implement a more comprehensive one appear to be daunting.

At the current pay rates of Tasmanian library technicians it would mean the cost of wages alone for the creation of one record would be around $2.80 – this would mean the tagging labour cost of the 280 records in the testbed to the Tasmanian MAP specifications would be around $800. (It should be noted that this is a conservative estimate and does not include all overheads.)

ii) Possible Workflows

The focus group speculated about a number of workflow scenarios taking into account the current and potential practices in two of the organisations and traditional cataloguing workflows in the other organisations. The group decided that while there was no obviously perfect workflow arrangement they did come up with this framework:

1. Objects contributed by academics/teachers/librarians
2. Some metadata entered – at least title, perhaps description
3. Library staff alerted to new objects and tag subject content
4. System automatically tags for date entered and origin (ie TAFE Tasmania, State Library of Tasmania, University of Tasmania, Department of Education).
5. Extracted from local system and uploaded to central repository or harvested from local systems by bot/web services for the central repository
6. Access to central repository by all teaching/library staff at each institution – links to original (URL) - Or alternatively a federated search across all four systems might be a future possibility (implications for interoperability across sectors and for authentication).

An alternative model for the State Library of Tasmania and the Department of Education might include the tagging of records or of a whole data set e.g. State

Library of Tasmania Images http://images.statelibrary.tas.gov.au/ for export or OAI harvesting

iii) Metadata Tagging and Content Guidelines

During stages 1 and 2 the metadata sub-group developed content guidelines for each of the elements chosen as well as some general guidelines. The guidelines were framed using the experience gained by staff at the State Library and Department of Education in metadata, the experiences and discussions of the focus group in stage 1 and documentation from other organisations such as OTEN. The university sub-group used the guidelines when creating the metadata for use in the *Intralibrary* testbed, and the implications for using the guidelines in the real-world were discussed during the informal pilot testing.

3.6 Formal Discoverability Testing with the Tasmanian Metadata Application Profile

The Formal Discoverability testing began after the recruitment of a number of academic, teaching and library staff from each institution. Testing involved a combination of discoverability testing procedures set down by Liddy (2002b) and traditional information retrieval testing procedures.

i) Pre-test Questionnaire Survey Results

Participants General Background

The Participants were all employees of one of the participating organisations. The mix was fairly even. The positions the participants held were teachers, lecturers, educational designers, library technicians and librarians. For analysing the results of the testing the group decided to divide the participants into two groups: information professionals (those working or with a library background) and non-information professionals (those with mostly a teaching or instructional design background).

Participants Searching Background

All the participants regularly used the Internet to some extent. The participants were categorised into those who were ‘power users’ and those who were ‘casual users’. Power users typically used the internet every day and not only used Google and Yahoo, but indexes and specialised search engines, and specified that in their search strategies they used boolean and exact phrases as well as keyword searches. There was a high degree of overlap in the ‘power user’ group and ‘information professional’ group. However, the power user group was larger as several of the educational background participants also plainly had advanced searching skills.

ii) Search Strategies/Terms/Keywords

The participants were required to enter search terms/keywords into *Intralibrary* to get results to complete the tasks. None of the participants seemed to have any difficulty in devising strategies. Not surprisingly the power users tended to use the more complex strategies, whereas the other group tended to use single or couples of keywords. Advanced searches were not offered to the participants. All searches were keyword. The power users were slightly more successful in their searches. There was no discernable difference between the strategies adopted by information professionals and non-information professionals except that the information professionals contributed the greater number to the power user group.

iii) Recall andPrecision

The recall of items using the minimal metadata was good. In most cases at least one of the terms entered by the participants matched those in either the description or the

subject and more often than not there was more than one match. On a few occasions viewing the learning object still did not convince the participant that the item was relevant, showing perhaps a disjuncture between the metataggers perception of the object and the users, and the content of the metadata rather than the amount. This also seems to influence search times.

The major influence on the precision was the testbed. *Intralibrary* used an implicit boolean '*or'* operator in its searches. If users had a clear option of using an 'and' operator the precision would have been higher. The low figures re average precision indicated the retrieval system was not conducive to high precision values – because of the '*or*' operator. An additional limitation of *Intralibrary* was that there were no options for limiting or sorting results. However, the "average in list" figures show that the objectively relevant items usually ranked highly in the list of results.

Table 2. Averages of measures in the formal discoverability testing

Q No.	**Average Recall** (objective)	**Average Precision**	**Average in List**	**Average Search Time (mins)**
1	92%	11%	3	<1
2	66%	25%	7	4.5
3	95%	8%	2	2.5
4	97%	6%	1	1
5	100%	5%	3	<1
6	100%	6%	1	<1
7	87%	4%	5	4
8	95%	5%	2	1.5
9	100%	3%	2	<1
10	89%	9%	2	2
Total	**92%**	**8%**	**2.8**	**1.5 approx**

iv) Average in List

The minimal metadata appeared to allow *Intralibrary* to determine the relevance through weighting surprisingly well. The objectively relevant records were almost always in the first half on the first page of results. To see if this was a fortunate peculiarity of the *Intralibrary* search algorithm the same searches were performed in *Masterfile* with the same test records but different noise, and the results were similar – within the 20% range plus or minus. It would appear that weighting can be done satisfactorily with this small amount of metadata.

v) Average Search Time

The average search times would have to be thought of as rather high. This is especially the case when one takes into consideration that when participants were taking more than five minutes they were moved on to the next question. Also, as the corpus of records was small and only one record was chosen as objectively relevant for each task, the searches should have been quicker. However, as *Intralibrary* used a web interface and the server running the application was in Sydney, searches were subject to the vagaries of Internet traffic and network delays. While the timings compensated for such delays, it was felt that the server being so far away had an impact. In a production system with a server located in Tasmania the results could be better.

vi) Post-test Questionnaire Results

1. What percentage of times did you find answers to the questions?

Answer	Number	Answer	Number
0%	-	60%	-
10%	-	70%	1
20%	-	80%	3
30%	-	90%	4
40%	-	100%	4
50%	-		

The answers to this question showed that the participants tended to underestimate the relevance of the search results. Interestingly though, half of those who thought they achieved 100% of the relevant answers in fact did not (they got 9/10 and 8/10). A reminder that relevance can never be entirely objective. However, the overall results did show that the metadata produced essentially the expected relevant results and in most cases were judged as such by the users.

2. How relevant were the items retrieved on average?

While most participants believed the majority of searches produced relevant items there was the minor inconsistency compared to the objective relevance of the results as mentioned above. Those defined as casual users chose either 3 or 4 on the Lickert scale, reflecting perhaps their slightly less successful searching.

Relevance	**Number of participants**
1 (Never relevant)	-
2	-
3	2
4	3
5 (Always Relevant)	5

Note: not all participants answered all questions.

3. How easy was it to determine if a retrieved item was relevant/a good result?

Most participants said they found it very easy/easy to determine the relevance of objects. Two said they found it difficult, both were information professionals.
The general positive agreement for this question is reflected in the comments given in answer to the next question as well.

Ease	**Number of participants**
1 (Very Easy)	5
2	4
3	1
4	2
5 (Very Difficult)	-

4. What did you like the best about searching this system?

The majority of participants commented on the usefulness of the description metadata. It seems that these were used almost exclusively for making relevance judgments. Some examples of the type of comments are: 'You get info before clicking before bringing up resource' | 'intuitive' | 'I was able to determine the

relevance of each search result by reading the descriptions on the search results page. They contained all the information I needed' | 'Clear appearance of results in search results boxes' | 'At times there was enough information in the description to answer query' | 'Keyword searches seemed to work most of the time, summaries of what is included is useful' | 'The separated boxes for descriptions helpful in scanning text for keywords'.

5. What did you like the least about searching this system?

Several people just put a line through this question. The most common complaints were about the *Intralibrary* interface, such as the way learning objects were displayed in a separate screen. No-one commented directly about the metadata, but one person said they thought the descriptions were too academic.

6. If you could change any aspect(s) of this system, what would it be?

Several participants left this question blank also. Two commented that a % relevance score as with Google would have been good. A number implied that the way *Intralibrary* allowed you to view the resource could have been better, and suggestions such as a frame where the resource could be viewed or a thumbnail image were made.

7. Do you have any suggestions about improving ways of finding Learning Objects?

One person suggested shorter descriptions of the objects, several mentioned either categories or a drop down/pop-up thesaurus, one suggested teachers rather than librarians should tag the objects, whereas another said librarians should tag because teachers didn't have time.

8. Please add any comments that would help us evaluate the process:

Only four people made comments, one jocular, two said they'd like to do more searching to make a considered assessment of the system, and one suggested more teachers be used for the evaluation.

3.7 Discussion

The minimalist Tasmanian Metadata Application Profile provided enough metadata for discovery in most circumstances. The discovery was within the bounds of usability and reasonable efficiency. The minimalist Tasmanian Metadata Application Profile certainly provides a firm base on which to build further.

The search strategies did not differ markedly between the groups, nor did the results, although the *casual user* group did produce by far the least successful searches. If there was any significant correlation it was that the library staff tended to use more terms when searching and often therefore, produced a larger result set. Whereas the teaching staff used simpler more specific strategies and were more analytical and particular regarding the result set and making a decision about what material satisfied the task. Neither group appeared to have difficulties finding appropriate search terms. Whether the description was tagged by the content providers (teaching staff) or professional cataloguers had implications and affected discoverability, but not in a uniformly positive or negative way. The records tagged by teaching staff were found just as often, but the questions eliciting these records as results needed to be framed very specifically, as the teachers used very specific words or jargon in their descriptions. Because of the small number of searchers/testers this requires further investigation in future studies.

The testing did indicate that when using a minimalist schema such as ours the quality of the metadata, always crucial, becomes even more so, and the options for correcting poor result sets through limiting or sorting are few. The less metadata used the more likely poor data will impact on searches as one defect becomes a higher proportion of the whole record. Also with learning objects the quality of metadata takes on greater importance because in-context keywords cannot be relied upon to assist in searching as the format often does not allow for in-context keywords to be discerned – eg pictures, multiple files, zip files etc. The testing also showed that good recall relies heavily on the content and breadth of the description tag, whereas precision relies heavily on the content of the subject tag. The group also found that it is difficult to separate out metadata for discoverability alone in a repository where the full resource found might not be available for viewing – that is the metadata alone is relied on for making a judgement about a resource – this would be a balancing act when trying to implement a minimalist, affordable schema.

The group found that an appropriate and affordable metadata schema in a cross sectoral environment is possible. Each sector had subtly different needs and aims and while the matter of identifying a controlled vocabulary suitable to all was difficult, the development of a schema was not difficult.

4. Conclusion

Most significantly the researchers found that educators are most interested in subject relevance when searching for materials. Metadata elements such as level, creator, sector, type and format were not missed by participants, nor was it requested as an improvement by teaching staff in post-test questionnaires. (Although the post-test questionnaire did not specifically ask this question and participants may not have thought to volunteer the suggestion). These elements were probably interesting and sometimes useful but not essential for discovery. Participants searched by subject and judgements regarding relevance of learning objects were determined by title and description in the displayed records. Sometimes participants opened the resource to clarify their choice.

In summary, then, subject, title and description metadata elements were seen as essential for resource discovery. Further, the project found that high quality discovery metadata can be achieved by ensuring that metadata tagging guidelines, and metadata content quality assurance processes are in place to support and encourage the best title/description information and assignment of subject terms.

This research produced some evidence to support the minimalists in the metadata community. The researchers found that tagging items to begin a repository from scratch would require a prohibitive commitment of time and funds if an extensive amount of metadata for each item was required. They also found that the principal concerns regarding discoverability with minimal metadata were unfounded, acknowledging that the number of resource discovery searchers/testers was small. Indicative findings are that educators were happy to make their own assessments about learning objects which largely precluded the need to include metadata regarding someone else's evaluation and that metadata relating only to the object at the time it was created or contributed would often become irrelevant in its new *re-used* context.

The four organisations involved in this research, despite being closely aligned, found that simply endeavoring to cooperate on a project such as this brought up issues relating to interoperability including the following:

- the political and cultural barriers to achieving interoperability can be easily underestimated;
- the need for some analysis of the relationship between the vertical and horizontal levels of interoperability and technical difficulty/costs of development;
- those responsible for developing metadata infrastructure in their respective communities need to study closely the relevant existing interoperability frameworks before embarking on framing future strategic developments; and,
- when entering into agreements to do with interoperability it is necessary to acknowledge that interoperability is ultimately a matter of agreeing on "trade-offs" between levels of desired functionality and the cost of implementation.

Projects such as the development of the COLIS Demonstrator provide an invaluable opportunity to work collaboratively on issues of interoperability in a real-world environment.

5. Recommendations

The research team believed that the outcome of the research gave cause to make some recommendations, namely:

1. Further research, preferably conducted as a correlation study, is needed. An increased sample size of both records and participants and a richer and more rigorous research methodology are required to verify the indicative findings of this study.
2. That the four organisations involved in this study continue to liaise regarding the development and implementation of metadata applications profiles or schemas and should endeavour to secure funding to establish a shared learning object repository for testing and development.
3. If Tasmanian cultural and educational organisations decide to take a federated approach to sharing learning objects, that the Tasmanian Metadata Application Profile be developed by gradually extending this base minimal metadata application profile in an experimental situation.
4. Tasmanian cultural and educational organisations should consider entering into negotiations for sharing learning objects in the very near future
5. Any organisation intending to develop or implement a metadata application profile should seriously consider their needs and conduct some real-world testing of proposals before expending significant amounts of money or time and effort. There are considerable cost benefits in winnowing out the 'nice' from the necessary.
6. Research into methods of mapping between thesauri is required. There are inadequacies with the available thesauri. Trying to find a good, general thesaurus for Australian objects was difficult.

6. References

Higgs,P., Meredith, S., Hand, T.(2003) *Flexible Learning Leader 2002 Report: Technology for Sharing - A research project to inform VET Australia about Learning Objects and Digital Rights Management including systems and metadata to support them. ANTA*

Hodgins W., Conner, M. (2000), *Everything you wanted to know about standards but were afraid to ask.* Internet: http://www.linezine.com/2.1/features/wheyewtkls.htm

Liddy, E.D. (2002a), A Modest (Metadata) Proposal in How Important is Metadata? Panel moderated by Carl Lagoze. *Joint Conference on Digital Libraries* (JCDL) 2002. Portland, OR.

Liddy, E.D. (2002b) Automatic Metadata Generation & Evaluation. American Society for Information Science & Technology (ASIST) 2002: Information Access in the Global Information Economy. Philadelphia, PA.

McGreal, R., Roberts, T. (2001) *A Primer on Metadata for Learning Objects,* TeleEducation NB.

McLean, N (2003) *Building Sustainable Metadata Infrastructure*, IMS Australia, 2003 http://www.siderean.com/dc2003/20031003_Building_Sustainable_Metadata_Infrastructure.pdf

Nielsen, Jakob (2000) 'Why You Only Need to Test With 5 Users' Jakob Nielsen's Alertbox, March 19, 2000. Internet: www.useit.com/alertbox/20000319.html

Sokvitne, L. (2000), An evaluation of the effectiveness of current Dublin Core metadata for retrieval in *Books & Bytes: 10th Biennial VALA conference & exhibition*. Melbourne 16-18 February 2000. p.443-457. Internet: http://www.service.tas.gov.au/papers/vala2000metadatapaper.asp

State Library of Tasmania (2003) *Costing the production of metadata*. Internet: http://www.stors.tas.gov.au/au-7-0002-00038

TAFE NSW (2002), TAFE NSW report on subject control from TAFE NSW Online Project 8. Metadata. Report and Recommendations. Overview.

University of Tasmania, State Library of Tasmania, Tasmanian Department of Education, TAFE Tasmania (2004), *Real World Metadata Management for Resource Discovery: proof of concept across education and library sectors in Tasmania (Education Researchers' Report, Interaction of IT Systems & Repositories Project 2003-2004).* Internet: http://www.stors.tas.gov.au/au-7-0005-00002

7. Referenced Metadata Schema and Application Profiles

AGLS Metadata Element Set
http://www.naa.gov.au/recordkeeping/gov_online/agls/summary.html

Dublin Core Metadata Element Set,v1.1 [DCMES]
http://www.dublincore.org/documents/dces/

EdNA Metadata Standard V1.1 http://www.edna.edu.au/edna/go/pid/385

National Library of Australia, State Library of Tasmania *Guidelines for the Creation of Content for Resource Discovery Metadata*
http://www.nla.gov.au/guidelines/metaguide.html

IEEE LTSC Learning Object Metadata
http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf

TAFE NSW. Open Training and Education Network. Distance Education Version1.2 (2003)TAFE Online Project 8 Metadata: Metadata tagging guidelines

The Le@rning Federation Metadata Application Profile V1.3
http://www.thelearningfederation.edu.au/repo/cms2/tlf/published/8519/Metadata_Application_Profile_1_3.pdf

UK Learning Object Metadata Core Draft 0.1
http://www.cetis.ac.uk/profiles/uklomcore/uklomcore_v0p1.doc